CLAIMS

1. A process for converting oxygenate to olefins which comprises:

contacting a feedstock comprising oxygenate with a catalyst comprising a molecular sieve under conditions effective to produce a vaporous product comprising said olefins, water and unreacted oxygenate;

condensing said vaporous product to provide a liquid stream rich in said water and unreacted oxygenate, and an olefins-rich vapor stream;

introducing at least part of said liquid stream to a feed tray in a fractionation tower which provides an oxygenate-rich overhead product and a water-rich liquid bottoms product;

providing a liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate above said feed tray; and

passing said olefins-rich vapor stream through a recovery train to recover at least some of said olefins.

2. The process of claim 1 wherein said oxygenate is selected from the group consisting of methanol and ethanol.

3. The process of claim 1 wherein said oxygenate comprises methanol.

4. The process of claim 1 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is introduced at more than one level above said feed tray.

5. The process of claim 1 wherein at least two liquid, oxygenate-rich streams comprising at least about 20 wt% oxygenate, are introduced above said feed tray.

6. The process of claim 5 wherein said at least two liquid, oxygenate-rich streams comprising at least about 20 wt% oxygenate, are each introduced at a separate level above said feed tray.

7. The process of claim 1 wherein said oxygenate-rich overhead product comprises liquid.

8. The process of claim 1 wherein said oxygenate-rich overhead product comprises vapor.

9. The process of claim 1 wherein said oxygenate-rich overhead product comprises liquid and vapor.

10. The process of claim 3 wherein at least a portion of said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is said feedstock.

11. The process of claim 3 wherein at least a portion of said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is derived from the bottoms product of a methanol absorber tower.

12. The process of claim 11 wherein liquid methanol feedstock is introduced to the process by addition to said methanol absorber tower.

13. The process of claim 12 wherein said liquid methanol feedstock comprises at least about 95 wt% methanol.

14. The process of claim 12 wherein said liquid methanol feedstock comprises at least about 99 wt% methanol.

15. The process of claim 3 wherein at least a portion of said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is derived from the bottoms product of a liquid-liquid absorber.

16. The process of claim 15 wherein a first cut fractionating tower, which treats olefins-rich overhead derived from a methanol absorber tower, provides i) an olefins-rich overhead stream and ii) a methanol-rich bottoms stream which is directed to said liquid-liquid absorber.

17. The process of claim 15 wherein wash water is added to said liquid-liquid absorber.

18. The process of claim 3 which further comprises treating said olefins-rich overhead from said condenser in at least one suction drum to remove liquid from said olefins-rich overhead which liquid is directed to said fractionation tower above said feed tray.

19. The process of claim 18 which further comprises compressing said olefins-rich overhead taken from said suction drum.

20. The process of claim 19 which further comprises treating said compressed olefins-rich overhead in an additional suction drum to remove liquid from said olefins-rich overhead which liquid is directed to an upstream suction drum.

21. The process of claim 20 which further comprises compressing said olefins-rich overhead taken from said additional suction drum.

22. The process of claim 21 which further comprises introducing said compressed olefins-rich overhead taken from said additional suction drum to a

discharge drum whose olefins-rich overhead is directed to a methanol absorber and whose oxygenate-rich bottoms are directed to said additional suction drum.

23. The process of claim 11 wherein said bottoms product of said methanol absorber tower is directed above said feed tray in said fractionation tower.

24. The process of claim 11 wherein said bottoms product of a methanol absorber tower is directed to a suction drum whose bottoms are directed above said feed tray in said fractionation tower.

25. The process of claim 1 wherein said condenser is selected from the group consisting of quench tower, heat exchanger, flash drum, and primary fractionator.

26. The process of claim 1 wherein said condenser is a quench tower.

27. The process of claim 1 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is provided as reflux above said feed tray.

28. The process of claim 1 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is provided above said feed tray to a reflux drum associated with said fractionation tower from which reflux drum an oxygenate-rich overhead product stream is taken.

29. The process of claim 28 wherein said feedstock comprising oxygenate comprises oxygenate-rich overhead product stream taken from said reflux drum.

30. The process of claim 1 wherein said feedstock comprising oxygenate comprises said oxygenate-rich overhead product from said fractionation tower.

31. The process of claim 1 wherein said oxygenate-rich overhead product from the fractionation tower is taken as a liquid drawoff from any tray above said feed tray.

32. The process of claim 1 wherein said oxygenate-rich overhead product from the fractionation tower is taken as a vapor drawoff from any tray above said feed tray.

33. The process of claim 1 wherein said oxygenate-rich overhead product from the fractionation tower is taken as a liquid from a downstream reflux drum.

34. The process of claim 1 wherein said oxygenate-rich overhead product from the fractionation tower is taken as a vapor from a downstream reflux drum.

35. The process of claim 1 wherein said oxygenate-rich overhead product from the fractionation tower is taken as a liquid and vapor from a downstream reflux drum.

36. The process of claim 1 wherein at least one of the group consisting of a) at least one vapor oxygenate-rich overhead product and b) at least one liquid oxygenate-rich overhead product, is taken from said fractionation tower.

37. The process of claim 1 wherein said oxygenate-rich overhead product from said fractionation tower is used as fuel.

38. The process of claim 1 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate comprises liquid blowdown from a vaporizer treating said feedstock prior to said contacting of said feedstock.

39. The process of claim 1 wherein said fractionation tower comprises a condenser which is heat integrated with a vaporizer for said feedstock.

40. The process of claim 1 wherein said oxygenate-rich overhead product from said fractionation tower is contacted with said catalyst prior to said contacting with feedstock under conditions sufficient to increase the carbon content of said catalyst.

41. The process of claim 1 wherein said water-rich liquid bottoms product contains at least about 99 wt% water.

42. The process of claim 1 wherein said oxygenate-rich overhead product contains no more than about 50 wt% water.

43. The process of claim 1 wherein said oxygenate-rich overhead product contains no more than about 25 wt% water.

44. The process of claim 1 wherein said oxygenate-rich overhead product contains no more than about 15 wt% water.

45. The process of claim 1 wherein said oxygenate-rich overhead product contains no more than about 10 wt% water.

46. The process of claim 1 wherein said oxygenate-rich overhead product contains at least about 25 wt% methanol plus other oxygenates.

47. The process of claim 1 wherein said oxygenate-rich overhead product contains at least about 50 wt% methanol plus other oxygenates.

48. The process of claim 1 wherein said oxygenate-rich overhead product contains at least about 75 wt% methanol plus other oxygenates.

49. The process of claim 1 wherein said oxygenate-rich overhead product contains at least about 90 wt% methanol plus other oxygenates.

50. The process of claim 40 wherein at least about 10 wt% of said oxygenate-rich overhead product comprises oxygenates other than methanol.

51. The process of claim 1 wherein said oxygenate-rich overhead product comprises liquid.

52. The process of claim 1 wherein said oxygenate-rich overhead product comprises vapor.

53. The process of claim 1 wherein said oxygenate-rich overhead product comprises liquid and vapor.

54. The process of claim 1 wherein said fractionation tower comprises packing.

55. The process of claim 1 wherein said fractionation tower comprises a fixed number of actual stages ranging from a condenser at the top as the first stage to a reboiler at the bottom as the last stage.

56. The process of claim 55 wherein said feed tray is located at about the middle of said actual stages.

57. The process of claim 56 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is introduced at or above the actual

stage corresponding to about 60% wherein the first stage corresponds to about 100% and the last stage corresponds to about 0% of the actual stage position.

58. The process of claim 56 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is introduced at or above the actual stage corresponding to about 80% wherein the first stage corresponds to about 100% and the last stage corresponds to about 0% of the actual stage position.

59. The process of claim 56 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is introduced at or above the actual stage corresponding to about 90% wherein the first stage corresponds to about 100% and the last stage corresponds to about 0% of the actual stage position.

60. The process of claim 56 wherein said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate is introduced at or above the actual stage corresponding to about 96% wherein the first stage corresponds to about 100% and the last stage corresponds to about 0% of the actual stage position.

61. The process of claim 55 wherein said number of actual stages ranges from about 20 to about 100.

62. The process of claim 55 wherein said number of actual stages ranges from about 40 to about 60.

63. An apparatus for converting oxygenates to olefins which comprises:

a reactor for contacting a feedstock comprising oxygenate with a catalyst comprising a molecular sieve under conditions effective to produce a vaporous product comprising said olefins, water and unreacted oxygenates;

a condenser for condensing said vaporous product to provide a liquid stream rich in said water and unreacted oxygenate, and an olefins-rich vapor stream;

a fractionation tower comprising a feed tray for receiving at least part of said liquid stream, and an inlet for receiving a liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate above said feed tray, said fractionation tower providing an oxygenate-rich overhead product and a water-rich liquid bottoms product; and

a recovery train for recovering olefins from said olefins-rich vapor stream.

64. The apparatus of claim 63 wherein said oxygenate is selected from the group consisting of methanol and ethanol.

65. The apparatus of claim 63 wherein said oxygenate comprises methanol.

66. The apparatus of claim 63 wherein said fractionation tower comprises inlets at more than one level above said feed tray for introducing said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate.

67. The apparatus of claim 63 wherein said fractionation tower comprises at least two inlets above said feed tray for introducing said liquid, oxygenate-rich streams comprising at least about 20 wt% oxygenate.

68. The apparatus of claim 67 wherein said fractionation tower comprises at least two inlets at separate levels above said feed tray for introducing said liquid, oxygenate-rich streams comprising at least about 20 wt% oxygenate.

69. The apparatus of claim 65 which further comprises a source of said feedstock which can provide at least a portion of said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate.

70. The apparatus of claim 65 which further comprises a methanol absorber tower from whose bottoms product can be derived at least a portion of said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate.

71. The apparatus of claim 70 wherein said methanol absorber tower comprises an inlet for addition of liquid methanol.

72. The apparatus of claim 65 which further comprises a liquid-liquid absorber from whose bottoms product can be derived at least a portion of said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate.

73. The apparatus of claim 72 which further comprises a methanol absorber tower which can provide an olefins-rich overhead, a first cut fractionating tower for treating said olefins-rich overhead, said first cut fractionating tower being capable of providing i) an olefins-rich overhead stream and ii) a methanol-rich bottoms stream which can be directed to said liquid-liquid absorber.

74. The apparatus of claim 72 wherein said liquid-liquid absorber comprises an inlet for adding wash water.

75. The apparatus of claim 65 which further comprises at least one suction drum for removing liquid from said olefins-rich overhead taken from said condenser, which liquid can be directed to said fractionation tower above said feed tray.

76. The apparatus of claim 75 which further comprises a compressor for compressing said olefins-rich overhead taken from said suction drum.

77. The apparatus of claim 76 which further comprises an additional suction drum for removing liquid from said compressed olefins-rich overhead, which liquid can be directed to an upstream suction drum.

78. The apparatus of claim 77 which further comprises an additional compressor for compressing said olefins-rich overhead taken from said additional suction drum.

79. The apparatus of claim 78 which further comprises a discharge drum for treating said compressed olefins-rich overhead taken from said additional suction drum, said discharge drum being capable of providing i) an olefins-rich overhead which can be directed to said methanol absorber and ii) oxygenate-rich bottoms which can be directed to said additional suction drum.

80. The apparatus of claim 70 wherein said bottoms product of said methanol absorber tower can be directed above said feed tray in said fractionation tower.

81. The apparatus of claim 70 wherein said bottoms product of the methanol absorber tower can be directed to a suction drum whose bottoms can be directed above said feed tray in said fractionation tower.

82. The apparatus of claim 63 wherein said condenser is selected from the group consisting of quench tower, heat exchanger, flash drum, and primary fractionator.

83. The apparatus of claim 63 wherein said condenser is a quench tower.

84. The apparatus of claim 63 wherein said fractionation tower comprises an inlet for receiving the liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate as reflux above said feed tray.

85. The apparatus of claim 63 wherein said fractionation tower comprises a reflux drum for receiving above said feed tray the liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate, from which reflux drum an oxygenate-rich overhead product stream can be taken.

86. The apparatus of claim 85 wherein said reflux drum comprises an outlet for directing oxygenate-rich overhead product stream taken from said reflux drum to above said feed tray.

87. The apparatus of claim 63 wherein said fractionation tower comprises an outlet for directing said oxygenate-rich overhead product from said fractionation tower to said reactor.

88. The apparatus of claim 63 wherein said fractionation tower comprises an outlet for directing said oxygenate-rich overhead product from said fractionation tower to a combustor.

89. The apparatus of claim 63 wherein said fractionation tower comprises an outlet or outlets for taking oxygenate-rich overhead product as a liquid drawoff from any tray above said feed tray.

90. The apparatus of claim 63 wherein said fractionation tower comprises an outlet or outlets for taking oxygenate-rich overhead product as a vapor drawoff from any tray above said feed tray.

91. The apparatus of claim 63 which comprises a reflux drum downstream of said fractionation tower, said reflux drum comprising an outlet for taking said oxygenate-rich overhead product as a liquid.

92. The apparatus of claim 63 which comprises a reflux drum downstream of said fractionation tower, said reflux drum comprising an outlet for taking said oxygenate-rich overhead product as a vapor.

93. The apparatus of claim 63 which comprises a reflux drum downstream of said fractionation tower, said reflux drum comprising an outlet for taking said oxygenate-rich overhead product as a liquid and a vapor.

94. The apparatus of claim 63 wherein said fractionation tower comprises at least one outlet for taking at least one of the group consisting of a) at least one vapor oxygenate-rich overhead product and b) at least one liquid oxygenate-rich overhead product, from said fractionation tower.

95. The apparatus of claim 63 which further comprises a vaporizer for treating said feedstock prior to said contacting of said feedstock, which vaporizer can provide said liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate as liquid blowdown from said vaporizer.

96. The apparatus of claim 63 wherein said fractionation tower comprises a condenser which is heat integrated with a vaporizer for said feedstock.

97. The apparatus of claim 63 wherein said fractionation tower provides an outlet for directing oxygenate-rich overhead product from said fractionation tower to contact said catalyst at a point before contacting the catalyst with the feedstock can occur.

98. The apparatus of claim 63 wherein said fractionation tower comprises packing.

99. The apparatus of claim 63 wherein said fractionation tower comprises a fixed number of actual stages ranging from a condenser at the top as the first stage to a reboiler at the bottom as the last stage.

100. The apparatus of claim 99 wherein said feed tray is located at about the middle of said actual stages.

101. The apparatus of claim 99 wherein said fractionation tower comprises an inlet for introducing liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate, at or above the actual stage corresponding to about 60% wherein the first stage corresponds to 100% and the last stage corresponds to 0% of the actual stage position.

102. The apparatus of claim 99 wherein said fractionation tower comprises an inlet for introducing liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate, at or above the actual stage corresponding to about 80% wherein the first stage corresponds to 100% and the last stage corresponds to 0% of the actual stage position.

103. The apparatus of claim 99 wherein said fractionation tower comprises an inlet for introducing liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate, at or above the actual stage corresponding to about 90% wherein the first stage corresponds to 100% and the last stage corresponds to 0% of the actual stage position.

104. The apparatus of claim 99 wherein said fractionation tower comprises an inlet for introducing liquid, oxygenate-rich stream comprising at least about 20 wt% oxygenate, at or above the actual stage corresponding to about 96% wherein the first stage corresponds to 100% and the last stage corresponds to 0% of the actual stage position.

105. The apparatus of claim 99 wherein said number of actual stages ranges from about 20 to about 100.

106. The apparatus of claim 99 wherein said number of actual stages ranges from about 40 to about 60.